भारतीय मानक
Indian Standard

IS 17650 (Part 1) : 2021

जलकुशल नल-साजी उत्पाद — अपेक्षाएँ

भाग 1 सैनिटरीवेयर

Water Efficient Plumbing Products — Requirements

Part 1 Sanitaryware

ICS 91.140.70

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December 2021 **Price Group 7**

Sanitary Appliances and Water Fittings Sectional Committee, CED 03

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Sanitary Appliances and Water Fittings Sectional Committee had been approved by the Civil Engineering Divisional Council.

Various sanitary appliances and fittings are used in plumbing system in buildings of various occupancy types, such as residential, educational, institutional, mercantile assembly and industrial. Plumbing systems used in the country are mainly based on water carriage system. Water is used as media for sanitizing and operation in sanitaryware and sanitary fittings. Due to increase in urbanization and increased use of various plumbing products within buildings, per capita water consumption has increased. This lead to the concern of water shortage and need for water conservation for the future generation in the country, and is a global concern too. Further, this increase in demand of water resulted in additional pressure on water supply systems and also additional water sources are required to meet this additional demand of water. This enhanced use of water may cause generation of more sewage, requiring more infrastructure for sewage transportation and treatment of the sewage. Considering this, it is felt that various fixtures used in plumbing system should be water efficient to reduce water demand while ensuring effective operation and maintenance of these appliances in the system.

This standard has, therefore, been formulated to lay down additional requirements for sanitaryware for their performance as water efficient plumbing products. It also covers the criteria for water efficiency rating and labelling of such products based on their flush volume. As per the standard, the product can be rated as either one star, two stars or three stars; higher the number of stars, the better would be the water efficiency rating of the products.

A series of Indian standards have been formulated for various sanitary appliances and fittings. This standard (Part 1) is formulated to provide additional requirements for assessment and rating of sanitaryware based on their water efficiency. The Part 2 of the standard covers such additional requirements for assessment and rating of sanitary fittings.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WATER EFFICIENT PLUMBING PRODUCTS — REQUIREMENTS

PART 1 SANITARYWARE

1 SCOPE

1.1 This standard (Part 1) covers requirements for assessment and water efficiency rating of sanitaryware, such as water closets, squatting pans, flush valves, flushing cisterns and urinals for their performance based on water efficiency, which are in addition to the requirements specified in relevant Indian Standards as applicable.

1.2 This standard is an adjunct to the concerned Indian Standards on sanitaryware, with respect to additional requirements for water efficiency.

1.3 This standard is not applicable to waterless urinals, flush cocks and integral wash basins with flushing cisterns.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions, which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the terms and definitions given in IS 2556 (Part 1), IS 2556 (Part 2), IS 2556 (Part 6), IS 2556 (Part 8), IS 2556 (Part 15) and IS 2556 (Part 16) shall apply.

4 REQUIREMENTS FOR WATER EFFICIENT WATER CLOSETS

4.1 This standard applies to water closets and their components as given below:

a) Water closet (WC) pan;
b) Squatting pan;
c) Flushing cistern;
d) Flush valve or any other water closet flushing device;
e) Combination of water closet pan and cistern; and
f) Combination of squatting pan and cistern.

4.2 General Requirement

4.2.1 The products covered under this standard shall conform to IS 2556 (Part 1), IS 2556 (Part 2), IS 2556 (Part 3), IS 2556 (Part 8), IS 2556 (Part 14), IS 2556 (Part 15) and IS 2556 (Part 16), IS 774, IS 7231, IS 9758, as applicable.

4.2.2 The water efficient cisterns conforming to IS 774 or IS 7231 shall have minimum discharge rate of 1.85 *l*/s.

4.3 Performance Tests

The sanitaryware shall meet the requirements specified for the following tests:

a) Surface wash test as per **4.6.1**;
b) Granule and ball test as per **4.6.2**;
c) Water extraction test (bean and sausage test) as per **4.6.3**;
d) Drain line transport characterization test as per **4.6.4**; and
e) Overflow test for gravity flush tanks as per **4.6.5**.

4.4 Additional Requirements for Water Efficient Wall Mounted Water Closet

4.4.1 *Non-standard Outlets*

Outlets that require connections other than a closet flange and ring shall not leak when tested in accordance with the procedure for joint seal test as given in **4.4.1.1**.

4.4.1.1 *Procedure for joint seal test*

Jointing shall be done in accordance with the manufacturer’s instructions and subjected to a hydrostatic pressure of 100 kPa for 15 min. If there is no evidence of leakage, the outlet and fixtures shall be considered to have met the requirements of this test.

4.5 Additional Requirements for Water Efficient Syphonic/Washdown Pedestal Water Closet

4.5.1 *Roughing-in Distance*

Water closet outlets roughing-in distance shall be specified in the manufacturer's installation instructions, which shall be 100 mm, 180 mm, 220 mm or 300 mm.

4.6 Performance Testing and Requirements

4.6.1 *Surface Wash Test*

4.6.1.1 *Procedure*

The surface wash test shall be conducted as follows:

a) Clean the flushing surface of the test bowl and then rinse and dry the flushing surface.

b) Draw a continuous horizontal ink line (with contrast colour with that of the bowl surface) with ink of concentration 0.5 percent aqueous solution of methylene blue, around the circumference of the flushing surface about 25 mm below the rim jet.

c) After flush, observe the ink line. Measure the inked line segments remaining on the flushing surface of the water closet for each quadrants as indicated in Fig. 1. Record these observations as per the format given in Table 1.

d) Repeat the above procedure (a) to (c) for 3 observations and calculate the average length of the line segments remaining on the flushing surface as per Table 1.

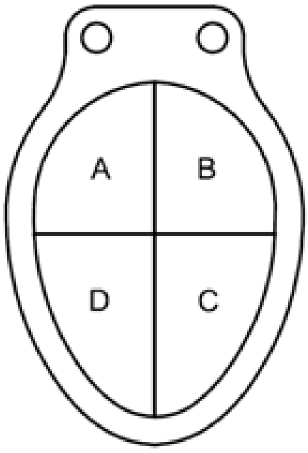


FIG. 1 DETAILS OF QUADRANTS FOR SURFACE WASH TEST

4.6.1.2 *Result*

The average length of the segments on the flushing surface shall not exceed 50 mm and no individual segment shall be longer than 15 mm.

Table 1 Surface Wash Test

[*Clause* 4.6.1.1 (c)]

Run No. (1)	Number of Ink Line Segments Remaining on the Flushing Surface (2)	Number of Ink Line Segments Remaining on the Flushing Surface of Each Quadrant (3)	Length of Each Segment mm (4)	Combined Length of Segment mm (5)
1		A		
		B		
		C		
		D		
2		A		
		B		
		C		
		D		
3		A		
		B		
		C		
		D		
Length of the longest segment, in mm				
Average combined length of the segments, in mm				

4.6.2 *Granule and Ball Test*

4.6.2.1 *Test media*

The test media shall consist of the following:

a) Cylindrical granules of high density polyethylene (HDPE) as per the specification given below:
   1) Total mass of 2 500 granules = (65 ± 1) g,
   2) Diameter = (4.2 ± 0.4) mm,
   3) Thickness = (2.7 ± 0.3) mm, and
   4) Density = (951 ± 10) kg/m^3.

b) Nylon balls as per the specification given below:
   1) Total mass of 100 balls = (15.5 ± 0.5) g,
   2) Diameter = (6.35 ± 0.25) mm, and
   3) Density = (1 170 ± 20) kg/m^3.

4.6.2.2 *Procedure*

The granule and ball test shall be conducted as follows:

a) Put 2 500 granules and 100 nylon balls inside the water closet pan/bowl after achieving constant water seal.

b) Flush the water closet and count the granules and nylon balls visible inside the bowl of water closet.

c) Measure and record the residual trap seal depth.

d) Repeat the methods given in Sl Nos. (a) to (c) for three times and record observations as per the format given in Table 2.

4.6.2.3 *Result*

Not more than 125 granules (5 percent of the original number) and not more than five balls (5 percent of the original number) shall be visible in the bowl after each flush.

4.6.3 *Waste Extraction Test (Bean and Sausage Test)*

4.6.3.1 *Apparatus*

The test apparatus shall be a drop guide placed across the top of the water closet pan/bowl with the centreline of a 50 mm diameter opening 150 mm in front of the centre of the seat post holes, equidistant from each hole. The drop guide:

a) may be made of plastic or other rigid material;

b) shall be no more than 12 mm thick; and

c) shall be of sufficient length to span the top of the water closet pan/bowl.

4.6.3.2 *Test media*

The test media shall consist of seven soybean paste cylinders and four loosely crumpled balls of toilet paper. The seven soybean paste cylinder shall have,

a) a nominal content of 34.9 percent water, 33.1 percent soybean, 18.5 percent rice, 12.2 percent salt, and 1.6 percent ethyl alcohol by weight;

   NOTE — Total percentage exceeds 100 percent due to rounding.

b) a density of (1.15 ± 0.10) g/ml (that is, density greater than that of water);

c) a mass of (50 ± 4) g per cylinder;

d) a length of (100 ± 13) mm;

e) a diameter of (25 ± 6) mm; and

f) a combined mass of (350 ± 10) g.

4.6.3.3 The soybean paste cylinder may be either uncased or cased. Cased cylinders

a) shall be encased with non-lubricated latex condoms;

b) shall be tied with a polymeric cord 1.0 mm in diameter that will not crack or harden with time; and

c) should be stored in airtight containers and refrigerated when not in use with a damp sponge placed in the bottom of the container to prevent the test cylinders from drying.

4.6.3.4 *Absorption test for the toilet paper*

During testing, the soybean paste cylinders shall be between 18 °C and 27 °C. Cased cylinders that have been stored in a refrigerator shall be acclimatized by flushing each cylinder at least three times prior to conducting testing.

4.6.3.5 Cased soybean paste cylinders shall be discarded after being subjected to 100 flushes. Soybean paste cylinders that are damaged in any way shall not be used. Soybean paste cylinders may contain small volumes of air; however, cylinders that float shall not be used.

Table 2 Granule and Ball Test

(*Clause* 4.6.2.2)

Run No.	Number of Granules in Bowl after Flushing	Numbers of Balls in Bowl after Flushing	Trap seal Restored or Not (Yes/No)	Residual Trap Seal Depth, H mm
(1)	(2)	(3)	(4)	(5)
1				
2				
3				

4.6.3.6 *Procedure*

The waste extraction test shall be conducted as follows:

a) Set the static water supply pressure to (350 ± 14) kPa.

b) Adjust the tank water level to the level specified in the manufacturer's instructions (that is, set to waterline), where applicable.

c) Flush at least three times prior to begin testing.

d) Set the inlet water temperature between 18 °C and 27 °C.

e) Readjust the tank water level to the proper level, if required.

f) Freely drop the seven soybean paste cylinders in a vertical orientation through the opening in the drop guide into the bowl.

g) Immediately remove the drop guide and freely and randomly drop the four balls of crumpled toilet paper over the centre of the bowl sump.

h) Wait (10 ± 1) s and then flush the bowl.

j) Record the test as "pass" or "fail". The test shall be recorded as a "fail" if any test media remains in the bowl or trap, or if a trap seal of at least 50 mm is not restored.

k) Flush the bowl again to clear the bowl and trapway and fully restore the trap seal.

m) Repeat the steps in Sl Nos. e) to j) four times, for a total of five test runs.

4.6.3.7 *Performance and report*

The specimen shall be deemed to have failed the test if any test media remains in the bowl or trap in more than one test run, or if a trap seal of at least 50 mm is not restored in more than one test run. The test report shall indicate if all test media was flushed out on at least four of the five test runs and whether or not the trap seal was restored.

4.6.3.8 *Result*

Water closet model performance shall be identified as either a "pass" or "fail", depending upon whether it can successfully and completely clear all test media from the fixture in a single flush, in at least four of five attempts. Tests where the toilet sample clogs, plugs, or fails to restore a minimum of 50 mm trap seal following each flushing test shall be deemed a failed test.

4.6.4 *Drain Line Transport Characterization Test*

4.6.4.1 *Test media*

Polypropylene balls shall be as per the specification given below:

a) Total mass of 100 balls = (300 ± 10) g,

b) Diameter = (19 ± 0.4) mm, and

c) Density = (833 ± 16) kg/m^3.

4.6.4.2 *Procedure*

The arrangement used for testing and the procedure shall be as given below:

a) Arrange the water supply line as shown in Fig. 2A.

b) Prepare the test assembly along with fitted specimen (water closet/squatting pan and flushing device assembly) as per Fig. 2B and Fig. 2C and set the water seal after repeated flushing for the desired volume of water.

c) Put 100 balls inside pan/bowl and flush the same. After flushing, record the distance travelled by each ball in the drain line as per the format given in Table 3.

d) Remove all balls from the test assembly. Repeat the procedure in Sl Nos. (b) and (c) for three times. Record the distance travelled by balls after the first flushing under the heading first run and those after second and third flushing under second run and third run, respectively.

The various components of the test assembly shall be as below:

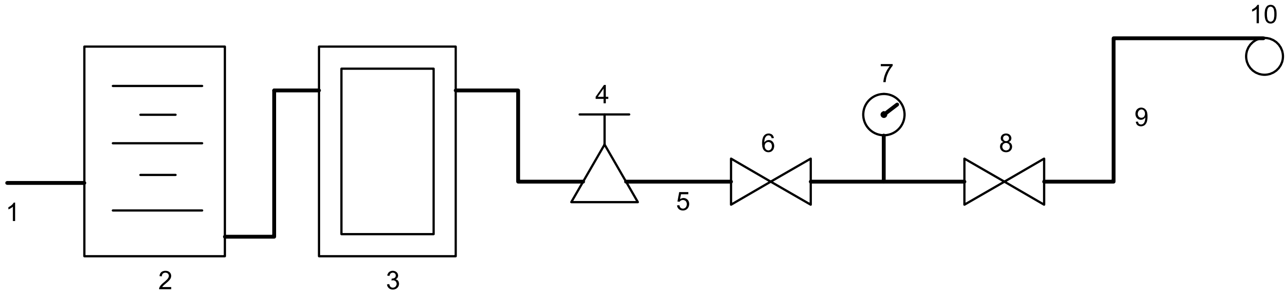
1) *Water supply* — Water for testing shall be clean. The minimum supply static pressure shall be 860 kPa.

2) *Filter* — A filter shall be used to remove particles and contaminants from the water to prevent interference with the operation of the water supply system or the water closet under test.

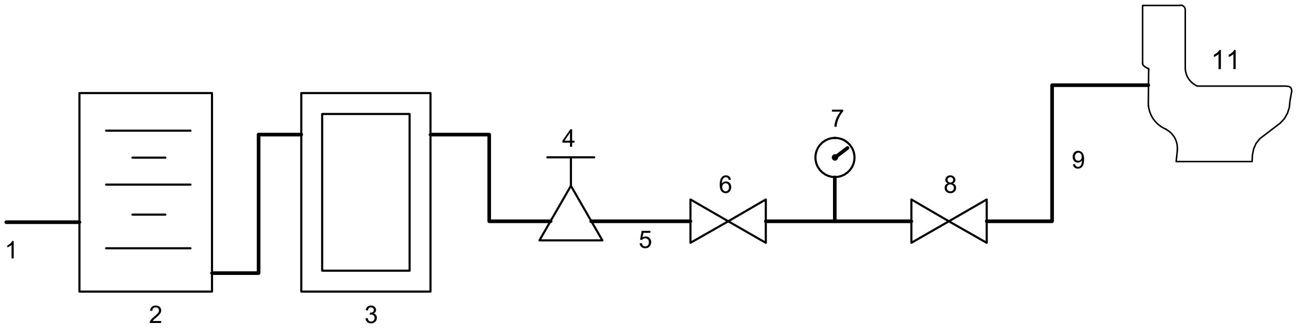
3) *Flow meter* — The flow meter shall cover a 0 to 38 l/min range and have an accuracy of 2 percent full scale. Variable area and turbine meters may be used.

4) *Pressure regulator* — The pressure reducing valve (regulator) shall be of range 140 kPa to 550 kPa and have discharge capacity not less than 38 l/min at fall off pressure of 35 kPa.

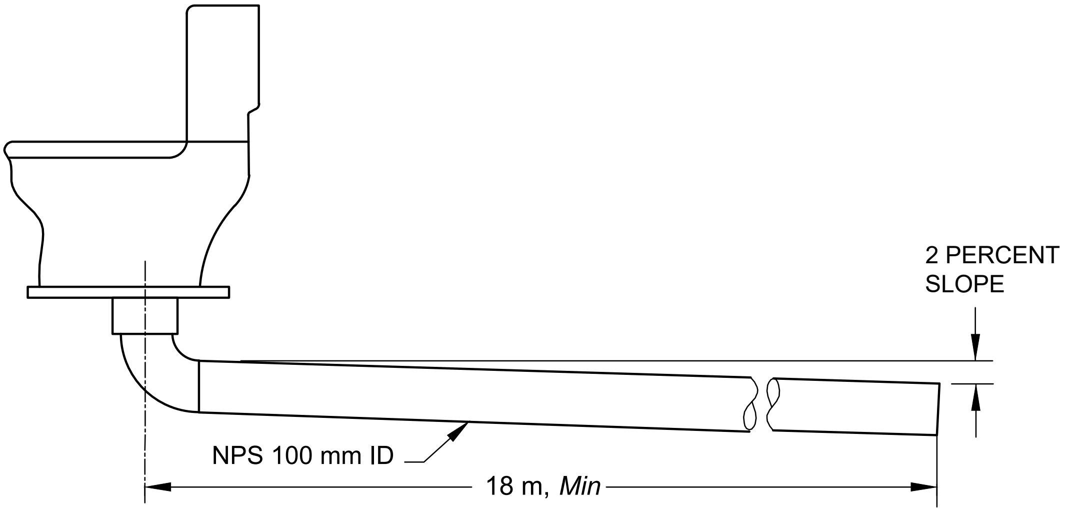
5) *Supply piping* — A minimum NPS-3/4 pipe or tubing shall be used.



2A Assembly for Drain Line Transport Characterization Test



2B Assembly with Specimen Fitted



NOTE — The tests are being conducted in consideration of venting system being provided for venting.

2C Transport Drain Line Characterization Assembly

KEY

1	WATER SUPPLY	7	PRESSURE GAUGE
2	FILTER	8	BALL OR GATE VALVE
3	FLOW METER	9	FLEXIBLE HOSE
4	PRESSURE REGULATOR	10	STOP VALVE
5	SUPPLY PIPING	11	SPECIMEN
6	VALVE		

Fig. 2 Drain Line Transport Characterization Test (Joined Pipe Length 18 m)

6) *Valve* — The control valve shall be a commercially available NPS-3/4 globe valve or equivalent to facilitate throttling.
7) *Pressure gauge* — The pressure gauge shall have a range of 0 to 690 kPa and least count of 10 kPa. Accuracy shall not be less than 2 percent full scale.
8) *Ball or gate valve* — This valve shall be used for on-off control (minimum NPS-3/4).
9) *Flexible hose* — The flexible hose shall connect the standardized supply to the water closet. The hose shall be minimum NPS-5/8 inside diameter.
10) *Stop valve* — The stop valve simulating a fill valve shall be NPS-3/8.
11) *Specimen* — The specimen shall be tested with tank and fill valve installed.
12) *Drain pipe* — Transparent pipe line shall be installed at 2 percent angle of pipe length 18 m.

4.6.4.3 *Report*

An overall measure of performance shall be determined by recording the location of the balls after flushing, under one of the eight categories of travel distance, as per the format given in Table 3. These categories represent various distances of travel down the drain line by the specimen balls left inside the pipe.

4.6.4.4 *Recording process*

a) Record the number of balls in each of the eight distance categories for each of the three test runs.
b) Combine the test run results to determine the total number of balls in each of the eight distance categories.
c) Calculate the weighted carry distance by multiplying the total number of balls in each category by the average distance travelled corresponding to that category. The average distance travelled for each category shall be 0, 1.5 m, 4.5 m, 7.5 m, 10.5 m, 13.5 m, 16.5 m and 18 m, respectively.
d) Calculate the total carry distance of balls by adding the eight weighted carry distances.
e) Calculate the average carry distance per ball by dividing the total carry by the total number of balls (3 × 100 balls = 300 balls).
f) The test results shall be reported in a format as given in Table 3.

4.6.4.5 *Result*

The average carry distance per ball shall be minimum 12.2 m.

4.6.5 *Overflow Test for Gravity Flushing Cisterns*

4.6.5.1 *Procedure*

a) Set up the water closet as per the arrangement in Fig. 2B.
b) The overflow test for gravity flushing cisterns shall be conducted as follows:
    1) Adjust the static pressure to 550 kPa.
    2) Open the water supply valve (valve indicated as 8).
    3) Set the fill valve in the fully open position and allow water to flow into the cistern so that it reaches the working water level and stops.

4.6.5.2 *Report*

There shall be no leakage during water discharge.

Table 3 Observation Table for Drain Line Transport Characterization Test

[*Clauses* 4.6.4.2, 4.6.4.3 *and* 4.6.4.4 (f)]

Sl No.	**Travel Distance**	**Number of Balls**			**Total Balls (Three Runs)**	**Average Distance Travelled**	**Weighted Carry Distance (Total Balls x Average Distance Travelled)**
		First Run	Second Run	Third Run			
	m					m	m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	In bowl or trap					0	
ii)	< 3					1.5	
iii)	3-6					4.5	
iv)	6-9					7.5	
v)	9-12					10.5	
vi)	12-15					13.5	
vii)	15-18					16.5	
viii)	> 18					18.0	
Total carry distance of balls:							
Average carry distance per ball (total carry distance/300):							

4.6.5.3 *Result*

Leakage or water escaping from the flushing cistern shall constitute failure.

4.7 If a WC pan, WC cistern, or flushing device is supplied separately, its testing and rating shall be based on the performance of a combination of a WC pan and WC cistern, or a WC pan and WC flushing device, nominated by the manufacturer, although the combination need not be the one that is supplied for the test.

4.8 The water efficient product as per this standard shall be supplied with a list of any components (for example a WC pan) that shall be connected to other components (for example a cistern) to achieve the water efficiency rating, and the necessary assembly and installation requirements.

5 REQIREMENTS FOR WATER EFFICIENT URINALS

5.1 This standard applies to the following types of urinals:

a) *Sensor Urinals* — The urinal in which water flow for cleaning is controlled by solenoid valve fitted along with sensor system.

b) *Other Urinals* — In these type of urinals, water comes in the urinal through inlet valve for flushing through flushing holes provided inside the urinal. The water consumption is controlled for reduced quantity of water through valve control mechanism, which regulates the water opening for each flush.

5.2 General Requirements

5.2.1 The urinals shall conform to IS 2556 (Part 6).

5.2.2 *Integral Trap Diameter*

Integral traps on urinals shall have a diameter that will allow a solid ball of minimum diameter of 20 mm to pass.

5.2.3 *Spuds*

For urinals operated by flushometer valves, the nominal spud size shall be minimum 20 mm. Other spud dimensions shall be as specified in the drawing of the product provided by the manufacturer.

6 SAMPLING AND CRITERIA FOR CONFORMITY

The scale of sampling and criteria for conformity shall be as given in the respective product standard for the operational and performance tests. The samples shall be taken from the lot presented for test for checking compliance as per the product standard.

7 REQUIREMENTS FOR WATER EFFICIENCY RATING

The water efficiency rating of water closet, squatting pan, flush valve and urinal shall be determined and the product shall be rated and labelled in accordance with Table 4 based on their water consumption requirements/flush volume. The flush volume of the product shall be determined in accordance with the method given in the respective product standard.

8 MARKING

8.1 Each piece of appliance shall be clearly and indelibly marked at a suitable place with the following, and other information as contained in relevant Indian Standard for the product.

a) Name or trade-mark of the manufacturer;

b) Batch/lot number; and

c) Water efficiency rating label as per **8.1.1**.

8.1.1 *Water Efficiency Rating Label*

8.1.1.1 Each appliance/sanitaryware which complies under the water consumption for rating criteria as per Table 4 shall be pasted with water proof sticker having water rating label. The carton containing the product shall also be pasted with a sticker as above. The sticker shall have water efficiency rating label (*see* Fig. 3) containing the following information:

a) Name and/or trade mark of the manufacturer;

b) Model number with name of the product;

c) Water efficiency rating for water efficient product, that is 1 star or 2 stars or 3 stars; and

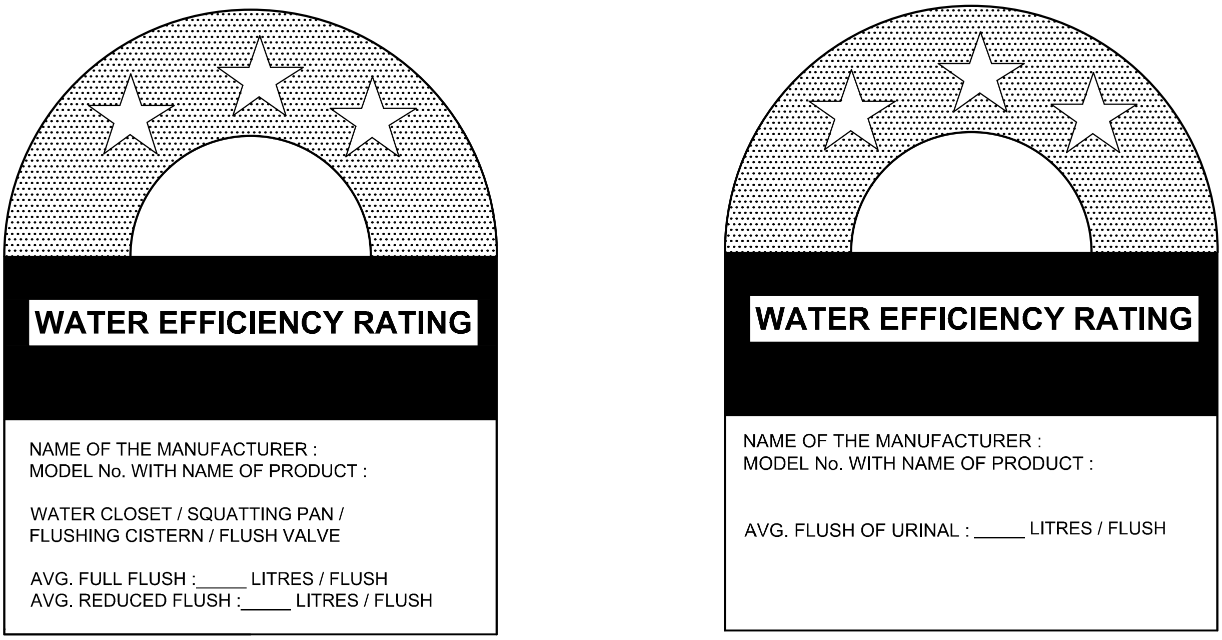
d) Average full flush and reduced flush in litres/flush in case of water closets, squatting pans, flushing cisterns and flush valves, and average flush in litres/flush in case of urinals.

8.1.1.2 The label shall be reproduced in full. The label shall be faithfully reproduced, and all text shall be readable with normal or corrected vision. The label shall be prominent and visible when the product is profiled, displayed, promoted, marketed, sold or supplied at any point in the supply chain.

Table 4 Water Efficiency Rating Criteria for Sanitaryware

(*Clauses* 7 *and* 8.1.1.1)

Sl No.	**Product**	**Water Consumption per Unit**	**Rating Criteria**		
			1 Star	2 Stars	3 Stars
(1)	(2)	(3)	(4)	(5)	(6)
i)	Water closet, squatting pan, flushing cistern, and flush valve	a) Full flush, litres/flush	Not more than 6.0 *l* per flush	Not more than 4.8 *l* per flush	Not more than 4.0 *l* per flush
		b) Reduced flush, litres/flush	Not more than 3.0 *l* per flush	Not more than 2.8 *l* per flush	Not more than 2.0 *l* per flush
ii)	Urinal	litres/flush	Not more than 3.0 *l* per flush (inclusive of pre-flush and post-flush, in case of sensor urinal)	Not more than 2.0 *l* per flush (inclusive of pre-flush and post-flush, in case of sensor urinal)	Not more than 1.0 *l* per flush (inclusive of pre-flush and post-flush, in case of sensor urinal)


WATER EFFICIENCY RATING
NAME OF THE MANUFACTURER :
MODEL No. WITH NAME OF PRODUCT :
WATER CLOSET / SQUATTING PAN /
FLUSHING CISTERN / FLUSH VALVE
AVG. FULL FLUSH :_____ LITRES / FLUSH
AVG. REDUCED FLUSH :_____ LITRES / FLUSH
WATER EFFICIENCY RATING
NAME OF THE MANUFACTURER :
MODEL No. WITH NAME OF PRODUCT :
AVG. FLUSH OF URINAL : _____ LITRES / FLUSH

3A Water Closet/Squatting Pan/Flushing Cistern/Flush Valve

3B Urinal

NOTE — The artwork of the label is only typical in nature.

Fig. 3 Label for Water Effeciency Rating of Sanitaryware

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
774 : 2021	Ceramic (vitreous China) flushing cisterns for water closets and urinals — Specification (*sixth revision*)
2556 (Part 1) : 2021	Vitreous China sanitary appliances — Specification: Part 1 General requirements (*fourth revision*)
2556 (Part 2) : 2004	Vitreous sanitary appliances (vitreous China) — Specification: Part 2 Specific requirements of washdown water closets (*fifth revision*)
2556 (Part 3) : 2004	Vitreous sanitary appliances (vitreous China) — Specification: Part 3 Specific requirements of squatting pans (*fifth revision*)
2556 (Part 6) : 2021	Vitreous China sanitary appliances — Specification: Part 6 Specific requirements of urinals and partition plates (*fifth revision*)
2556 (Part 8) : 2021	Vitreous China sanitary appliances — Specification: Part 8 Specific requirements of close-coupled and one-piece pedestal washdown and syphonic water closets (*sixth revision*)
2556 (Part 14) : 1995	Vitreous sanitary appliances (vitreous China) — Specification: Part 14 Specific requirements of integrated squatting pans (*first revision*)
2556 (Part 15) : 2004	Vitreous sanitary appliances (vitreous China) — Specification: Part 15 Specific requirements of universal water closets (*second revision*)
2556 (Part 16) : 2002	Vitreous sanitary appliances (vitreous China) — Specification: Part 16 Specific requirements of wash down wall mounted water closets
7231 : 2021	Plastic flushing cisterns for water closets and urinals — Specification (*third revision*)
9758 : 1981	Specification for flush valves and fittings for water closets and urinals

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Sanitary Appliances and Water Fittings Sectional Committee, CED 03

Organization	*Representative(s)*
Municipal Corporation of Greater Mumbai, Mumbai	Hydraulic Engineer (Shri A. S. Rathore) (***Chairman***)
Brihan Mumbai Licensed Plumbers' Association, Mumbai	Shri Kishor V. Merchant Shri Bijal M. Shah (*Alternate*)
Building Materials and Technology Promotion Council, New Delhi	Shri S. K. Gupta Shri C. N. Jha (*Alternate*)
Capstan Meters India Ltd, New Delhi	Shri Anurag Jaipuria Shri P. K. Jaipuria (*Alternate*)
Central Institute of Plastic Engineering and Technology, Chennai	Dr B. Srinivasalu Shri K. Prakalathan (*Alternate*)
Central Public Works Department, New Delhi	Shri M. K. Mallick Shri Divakar Agrawal (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Shri Ajay Chaurasia Shri Rajiv (*Alternate*)
Consumer Co-ordination Council, Delhi	Shri A. L. Saaha Shri S. C. Sharma (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (Design)
Delhi Jal Board, New Delhi	Chief Engineer (WW) II Superintending Engineer (NW) (*Alternate*)
Engineers India Ltd, New Delhi	Shri Samir Das Shri Rajesh Gujral (*Alternate* I) Shri Anish Mahala (*Alternate* II)
Geberit Plumbing Technology (India) Pvt Ltd, Bengaluru	Representative
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Northern Railway, New Delhi	Chief Engineer (P & D)
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Sanitary Appliances and Accessories Subcommittee, CED 3 : 1

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Central Public Works Department, New Delhi	Shri M. K. Mallick Shri Divakar Agrawal (*Alternate*)
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Geberit Plumbing Technology (India) Pvt Ltd, Bengaluru	Representative
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Organization	*Representative(s)*
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Tamil Nadu Water Supply and Drainage Board, Chennai	Joint Chief Engineer (COM) Joint Chief Engineer (PDC) (*Alternate*)
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Panel for Formulation of Standards for Requirements for Water Efficient Plumbing Products, CED 3 : P1

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